

**Remarks/Arguments:**

With this Response, no amendments are made to the claims. A copy of the claims currently pending is provided herewith for the convenience of the Examiner. Claims 1-7, 9, and 11-22 are pending.

**I. Summary of the Invention**

The present invention is directed to regenerating a sulfur-poisoned catalyst in an exhaust gas aftertreatment system that does not include a NO<sub>x</sub> trap. The catalyst is a PGM catalyst responsible for oxidation of carbon monoxide to carbon dioxide and of hydrocarbons in the exhaust gas to carbon dioxide and steam (water). Over time, sulfur binds with active oxidation sites on the catalyst of the system. If left unchecked, this binding of sulfur would reduce the overall oxidation activity of the catalyst and efficiency of the system. To counteract the poisoning effect of sulfur, the present invention modulates the air/fuel ratio ( $\lambda$ ) in pulses to 0.95 or richer (i.e., lower) to provide a series of peak enrichments of from 250 milliseconds to 5 seconds in duration for an aggregate time of from 10 seconds to 10 minutes to regenerate the catalyst in the system. In this manner, the system of the present invention can run a desulfation routine after a pre-determined time or distance driven (see Examples 1 and 2, for example) or "a-little-and-often" scheme in order to maintain catalyst function as desired.

**II. Discussion of Ito et al.**

Ito et al. appears to be directed to regenerating a sulfur poisoned catalyst of an internal combustion engine by (1) detecting the presence of oxygen in the exhaust gas downstream from a Pt catalyst susceptible to be poisoned by sulfur, and (2)(a) increasing the air-fuel ratio to above stoichiometric conditions for predetermined time period to the engine, or (2)(b) eliminating exhaust recirculating upstream of the Pt catalyst causing the exhaust system temperature to increase to over 600 °C, thereby desulfurizing the catalyst. See col. 6. lines 25-33 for detecting the presence of oxygen. See col. 10, lines 5-31 for increasing the air-fuel ratio. See col. 12, lines 6-26 for stopping the exhaust recirculation.

**III. The Office Action**

The Office Action rejects claims 1-3, 6-9, 11-17, and 20-22 under 35 U.S.C. § 103(a) as unpatentable over Ito et al. (U.S. 5,724,808). Specifically, in support of the obviousness rejection, the Office Action states the following:

. . . [Ito] fails to disclose the duration time of from 3 to 10 minutes.

It would have been obvious to one skilled in the art at the time the invention was made to provide a specific optimum range of regeneration times, since it has been held where the general conditions of a claim are disclosed in the prior art, discovering the optimum workable range involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

The Office Action states that claims 1, 13, and 16 clearly do not require the preamble for completeness, and as such, is denied the effect of a limitation of the claim.

The dependent claims, 2-6, 9, 11, 12, 14, 15, and 17-22, are also rejected under 35 U.S.C. § 103(a) as unpatentable over Ito et al. alone, or in view of Araki et al. (U.S. 5,850,735) or Hirota et al. (U.S. 6,199,374).

#### **IV. Applicant's Response**

In a prior Office Action of August 23, 2003, the Examiner rejected the pending claims over Hirota et al. stating at page 3:

Hirota discloses the claimed invention except for specifying the optimum range of the air fuel ratio peak enrichments . . . . It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide specific optimum ranges of peak enrichments, and duration of regeneration time, since it has been held that where general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

In response to this rejection, the applicant argued that Hirota et al. failed to recognize the peak enrichments and regeneration time as a result effective variable, the facts of *In re Aller* were distinguishable from the facts of the present case, and Hirota et al. does not disclose the general conditions of the claimed invention. The applicant's arguments were deemed persuasive to the Examiner because the Examiner presented new grounds for rejection using Hepburn et al (U.S. 5,974,788) in the March 15, 2004 Office Action.

With the present Office Action, the applicant submits that the Examiner has simply substituted a different reference which contains a similar disclosure as that of Hepburn et al. (a disclosure that is no more than a general statement that sulfur-poisoned catalysts can be regenerated by increasing the air-fuel ratio) and made the Office Action final. Moreover, the newly-applied reference fails to satisfy all of the elements of applicant's claimed invention, such

as modulating the air/fuel ratio ( $\lambda$ ) in pulses to 0.95 or richer to provide a series of peak enrichments of from 250 milliseconds to 5 seconds in duration for an aggregate time of from 10 seconds to 10 minutes.

For the same reasons that convinced the Examiner that the claims are patentable over the Hepburn et al reference, the applicant submits that the claims are patentable over Ito et al. More specifically, the applicant submits that the Examiner fails to set forth a *prima facie* case for obviousness because A) Ito et al. fails to disclosure two time periods at all, let alone the duration of each enrichment peak and the aggregate time of the peaks, as claimed, and fails to give values within any of the claimed ranges for these times; B) Ito et al. fails to recognize the peak enrichment periods and the duration of regeneration time as result-effective variables and C) the facts in *In re Aller* are distinguishable from the present case.

- A. Ito et al. fails to disclosure two time periods at all, let alone the duration of each enrichment peak and the aggregate time of the peaks, as claimed, and fails to give values within any of the claimed ranges for these times

The pending claims of this application specify two time periods, namely (1) the duration of each enrichment peak and (2) the aggregate time of the peaks. Thus, the claims specify a pulsing of peaks for relatively short durations for a claimed aggregate time. In particular, the durations are claimed to be between 250 milliseconds to 5 second while the aggregate time is between 10 seconds and 10 minutes.

Ito et al. fails to contemplate this type of control and would require further modification to meet the limitations set forth above. In particular, Ito et al. seems to imply maintaining a rich air to fuel ratio for a certain, although unspecified, predetermined time (e.g., TRICH). This arguably could be deemed the aggregate time but, if so, nothing in Ito provides any disclosure of a duration of enrichment peaks, let alone the contemplation that they are important or the time of the peaks are important. Moreover, Ito et al. fails to suggest a particular time for the "predetermined time period." Therefore, for a number of reasons, more than those just disclosed in the Office Action, Ito et al. fails to render the claimed invention obvious.

- B. Ito et al. fails to recognize the peak enrichment periods and the duration of regeneration time as result-effective variables

As stated in MPEP § 2144.05, a particular parameter must first be recognized as a result-effective variable, *i.e.*, a variable which achieves a recognized result, before the determination of the optimum or workable ranges of the variable might be characterized as

routine experimentation. *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977) (The claimed wastewater treatment device had a tank volume to contractor area of 0.12 gal./sq. ft. The prior art did not recognize that treatment capacity is a function of the tank volume to contractor ratio, and therefore the parameter optimized was not recognized in the art to be a result-effective variable.). See also *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980) (prior art suggested proportional balancing to achieve desired results in the formation of an alloy).

Ito et al. fails to recognize the peak enrichment periods and the duration of regeneration time as result-effective variables. At col. 10, lines 5-31, Ito et al. discloses that when a the three-way catalyst 14 has been detected to be poisoned, the air-fuel ratio feedback control is interrupted, and the air-fuel ratio correction coefficient KO2(?) is changed to a predetermined value as make the air-fuel ratio of the mixture supplied to the engine richer than the stoichiometric air-fuel ratio. The air-fuel ratio will remain rich until the expiration of a predetermined time TRICH.

First, Ito et al. disclose changing the fuel ratio richer than stoichiometric. In contrast, the presently claimed invention changes the air-fuel ratio to 0.95 or richer. Second, Ito et al. fails to recognize the importance of the "little and often" regeneration scheme using intermittent pulses of rich fuel, particularly, the intermittent spurts of rich air-fuel pulses and the aggregate time of those spurts. At least these two parameters, optimized in the present invention, are not recognized by Ito et al. as result effective variables. Thus, the present invention cannot be said to be merely optimizing those variables. Because this prerequisite for using "optimization of ranges" to support an obviousness rejection has not been satisfied, the MPEP mandates withdrawal of this rejection.

C. The facts of *In re Aller* are distinguishable from the facts of the present application

The facts in *In re Aller* are distinguishable from the present case. The applicant submits that Ito et al. is not like the prior art cited in *In re Aller* because Ito et al. does not cite a finite range of numerical values as general conditions of the present claims.

MPEP § 2144 states that an Examiner must apply the law consistently to each application after considering all the relevant facts. If the facts in a prior legal decision are sufficiently similar to those in an application under examination, the Examiner may use the rationale used by the court.

In this case, however, the facts of the cited legal decision are not sufficiently similar to the facts of this application. The Office Action cites *In re Aller* as standing for the proposition that where general conditions of a claim are disclosed in the prior art, discovering the optimal workable ranges involves only routine skill in the art. In *In re Aller*, a claimed process which was performed at a temperature between 40°C and 80°C and an acid concentration between 25% and 70% was held to be *prima facie* obvious over a reference process which differed from the claims only in that the reference process was performed at a temperature of 100°C and an acid concentration of 10%.

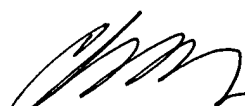
In contrast, Ito et al. does not cite a finite, numerical range for the duration of peak enrichments or the duration of regeneration time. Ito et al. only discloses that the air-fuel ratio is made richer than the stoichiometric air-fuel ratio depending on the output from a downstream oxygen sensor. See col. 10, lines 17-20. Moreover, the rich air-fuel is supplied to the engine for a predetermined time. Ito et al. does not provide a numerical range for this predetermined time or provide a variable that would affect the length of this predetermined time. The passage at col. 10, lines 21 and 23 merely states that the air-fuel ratio is returned to the normal operating state when the the downcount timer tm1 is equal to zero, i.e., whether or not the predetermined time period TRICH has not elapsed. The applicant submits that the teaching of Ito et al. using words, not numbers, to describe an infinite range for a variable is not the same as the prior art in *In re Aller*, which taught a finite, numerical range for a variable. Particularly probative is the complete absence in Ito et al. of any numerical range for the duration of peak enrichments and the duration of regeneration time.

Accordingly, the applicant submits that in applying *In re Aller* as standing for the proposition that where general conditions of a claim are disclosed in the prior art, discovering the optimal workable ranges involves only routine skill in the art, the Office Action erred. In particular, the prior art of *In re Aller* disclosed particular numerical ranges not far from the claimed values. In contrast, Ito et al. fails to disclose any numerical values whatsoever for at least two of the claimed variables. In view of the above, the applicant respectfully requests reconsideration.

**V. Conclusion**

For all of the foregoing reasons, the applicant respectfully requests the Examiner's reconsideration and submits that independent claims 1, 7, 13 and 16 are not obvious in view of Ito et al. and optimization of ranges when the general conditions of the invention are known in the prior art, citing *In re Aller*. Additionally, because claims 2-6, 9, 11, 12, 14, 15 and 17-20 depend either directly or indirectly from an allowable independent claim, they are also patentable. See, e.g., *In re McCarn*, 101 USPQ 411, 413 (CCPA 1954) ("sound law" requires allowance of dependent claims when their antecedent claims are allowed).

Respectfully submitted,

  
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